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ATIS-0100801.04.2005(S2020)

Multimedia Communications Delay, Synchronization, and Frame Rate

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ATIS-0100801.04.2005(S2020), *Multimedia Communications Delay, Synchronization, and Frame Rate*

Is an American National Standard developed by the ATIS **Network Performance, Reliability, and Quality of Service Committee (PRQC)**.

Published by
Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

ATIS-0100801.04.2005(S2020)

[Revision of T1.801.04.1997(R2002)]

American National Standard for Telecommunications

MULTIMEDIA COMMUNICATIONS DELAY, SYNCHRONIZATION, AND FRAME RATE

Secretariat

Alliance for Telecommunications Industry Solutions

Approved December 13, 2005

American National Standards Institute, Inc.

Abstract

This standard addresses delay and synchronization issues in Multimedia systems that may combine video, audio, and data channels. Video delay can vary widely over short sequences, audio and video sequences may be distorted during transmission, and data streams can have little or no structure and may contain bit errors. Although each media presents unique measurement challenges, the methods specified here meet and overcome them. This standard also gives considerations for joint measurements and specifications for internal clocks that provide time stamps. Performance standards development proceeds in three stages, specifying parameters, methods of measurement, and (usually numerical) limits for services, networks or equipment. This specification addresses the first two stages, laying a foundation for the third.

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Network Performance, Reliability, and Quality of Service Committee (PRQC) -- formerly T1A1 -- develops and recommends standards, requirements, and technical reports related to the performance, reliability and associated security aspects of communications networks, as well as the processing of voice, audio, data, image, and video signals, and their multimedia integration. PRQC also develops and recommends positions on, and foster consistency with, standards and related subjects under consideration in other North American and international standards bodies.

An aspect of true Multimedia Communications Systems that sets them apart from a mere collection of unrelated channels is their ability to maintain a temporal relationship between the different media. This standard specifies the parameters and measurement methods to assess relative synchronization between media channels, and two other key aspects of temporal quality. Transmission time or delay through a channel, is critical when assessing a system's suitability for conversational and other interactive uses. Frame inter-arrival time and its reciprocal, frame rate, characterize a system's ability to deliver information continuously and consistently.

Today's Multimedia systems combine video, audio, and data channels to enhance communications. This standard covers all these media. Video delay can vary greatly over short sequences, audio and video sequences may be distorted during transmission, and data streams can have little or no structure and may contain bit errors. Although each media presents unique measurement challenges, the methods specified here meet and overcome them. The Mean Square Error based method expects and measures instantaneous video delay variations if present, setting this approach apart from earlier methods. The audio delay method accommodates channels where the original speech waveform is not preserved and the delay may be time-varying. The data channel methods take advantage of native structures when possible and tolerate bit errors. All the methods allow test signals representative of the intended system application.

Performance standards development proceeds in three stages, specifying parameters, methods of measurement, and (usually numerical) limits for services, networks, or equipment. This specification addresses the first two stages, laying a foundation for the third.

This standard also gives considerations for joint measurements and specifications for internal clocks that provide time stamps. There is also a discussion of time stamp position in informative annex A. Annex B is a guide to the mathematical symbols used in the standard. For those who seek more information, a bibliography of related standards and publications may be found in Annex C. Annex D contains a full definition of the audio delay measurement algorithm described in clause 7, in the form of computer code.

This standard was originally developed by Technical Subcommittee T1A1 (now ATIS PRQC) under the Video Teleconference/Video Telephony Performance and Advanced Television Performance projects. The first project began in 1988 under the auspices of Technical Subcommittee T1Q1. The standard's most recent revision (2005) was developed under PRQC Issue A0024. The revised standard complements PRQC's recent specifications covering video test scenes, performance terms and definitions, and other objective measurements.

Suggestions for improvement of this standard will be welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, 1200 G Street, NW, Suite 500, Washington, DC 20005.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee PRQC. Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the PRQC had the following members:

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The Quality of Service (QoS) Task Force was responsible for the development of this document.

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1 SCOPE, PURPOSE, & APPLICATION

1.1 Scope

This standard covers test methodologies for multimedia transmission systems utilizing digital transport facilities. It gives a set of measurement parameters, without providing limits, to characterize the following aspects of system performance:

a) Active Video Frame inter-arrival time, which is the reciprocal of the elementary frame rate;
b) Visual channel transmission time, also called video delay;
c) Audio channel transmission time (or audio delay);
d) Data channel transmission time or delay (and frame inter-arrival time);
e) Temporal synchronization between channels.

This standard specifies methods of measurement for these parameters in the applications described in 1.3. The standard's scope is limited to cases where appropriate media input and output interfaces are present, or where these interfaces can be made available with optional test fixtures.

The following applications are beyond the scope of this standard:

a) *Measuring aspects of system performance other than delay, synchronization, and frame rate*. It is important to point out that delay, synchronization, and frame rate measurements do not completely characterize the quality of a multimedia transmission system. For example, the reproduction quality of Video Frames from input to output is also of obvious importance to users. Subjective test methods employing representative users yield the best available assessment of video transmission quality. The optimization of such subjective performance for all quality parameters may take precedence over the optimization of the result of parametric measurements performed according to this standard. The bibliography lists several international recommendations on subjective assessment methods for entertainment and teleconference quality video transmission systems. It also lists standards for assessment of audio and data channels.

b) *Unrestricted choice of useful and representative source content*. The methods of measurement specified here require restrictions on their source signals for testing. Video source sequences with high motion activity often cause increased delay, decreased frame rate, and skewed audiovisual synchronization in some multimedia applications. Therefore, measurements should use test scenes which are realistic for the application of the multimedia system under evaluation. Continuous audio tones or still video sequences will produce ambiguous delay measurements (but delay is of limited importance under these conditions). Other limitations are given in the sections for each measurement method.

c) *Measuring the performance aspects of systems where the input and output interfaces are not accessible*.